Local
Media

3

Pattern
Initialization
Subsystem

4

Master
Pattern
Database

Pattern
Recognition
Subsystems

2

1

Audio/Video
Interface
Subsystem

Internet

7

Broadcast and
Satellite
Audio and Video

5

Search Robot
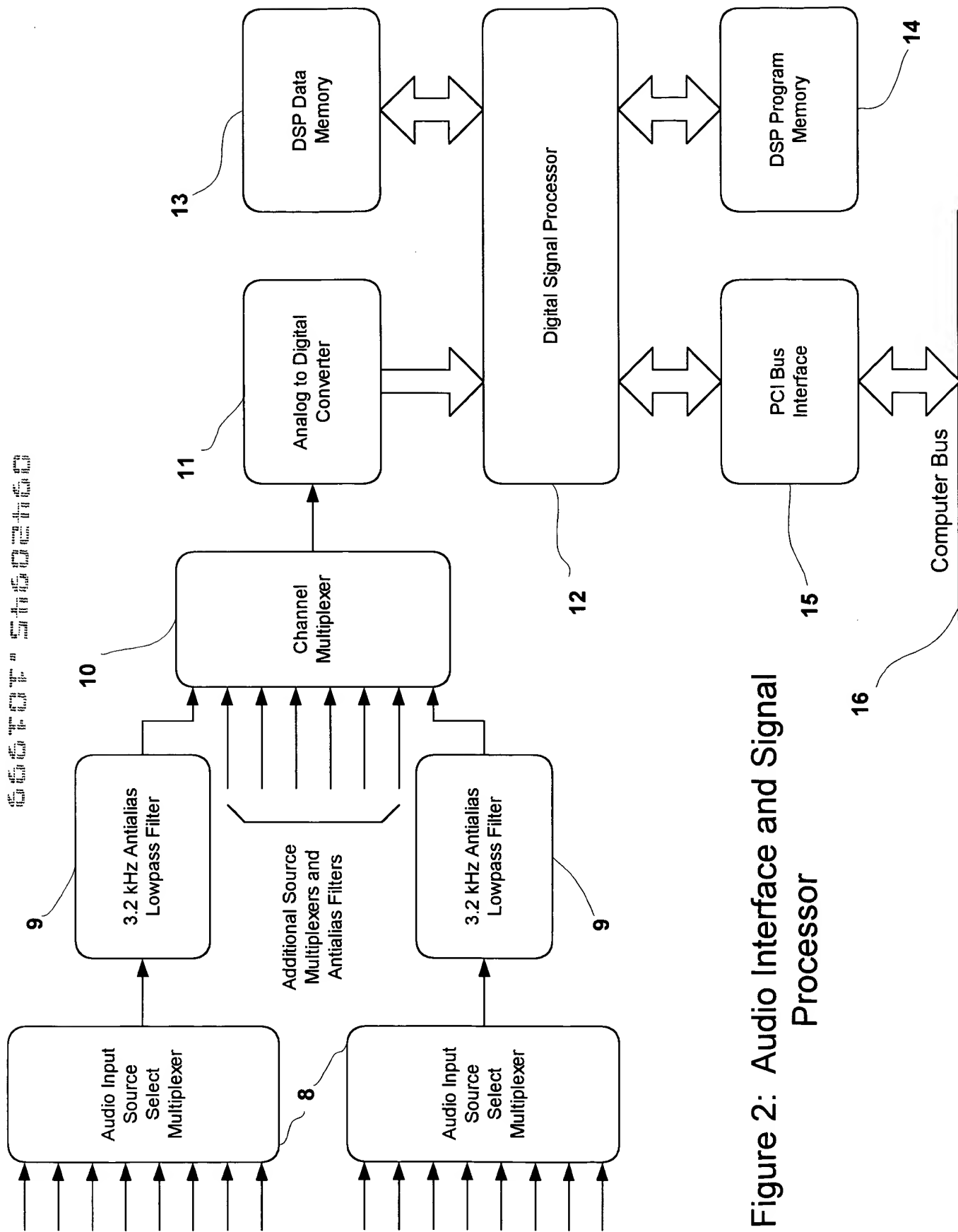and Scheduler

Management
Database
System

6

Figure 1: Signal Recognition System
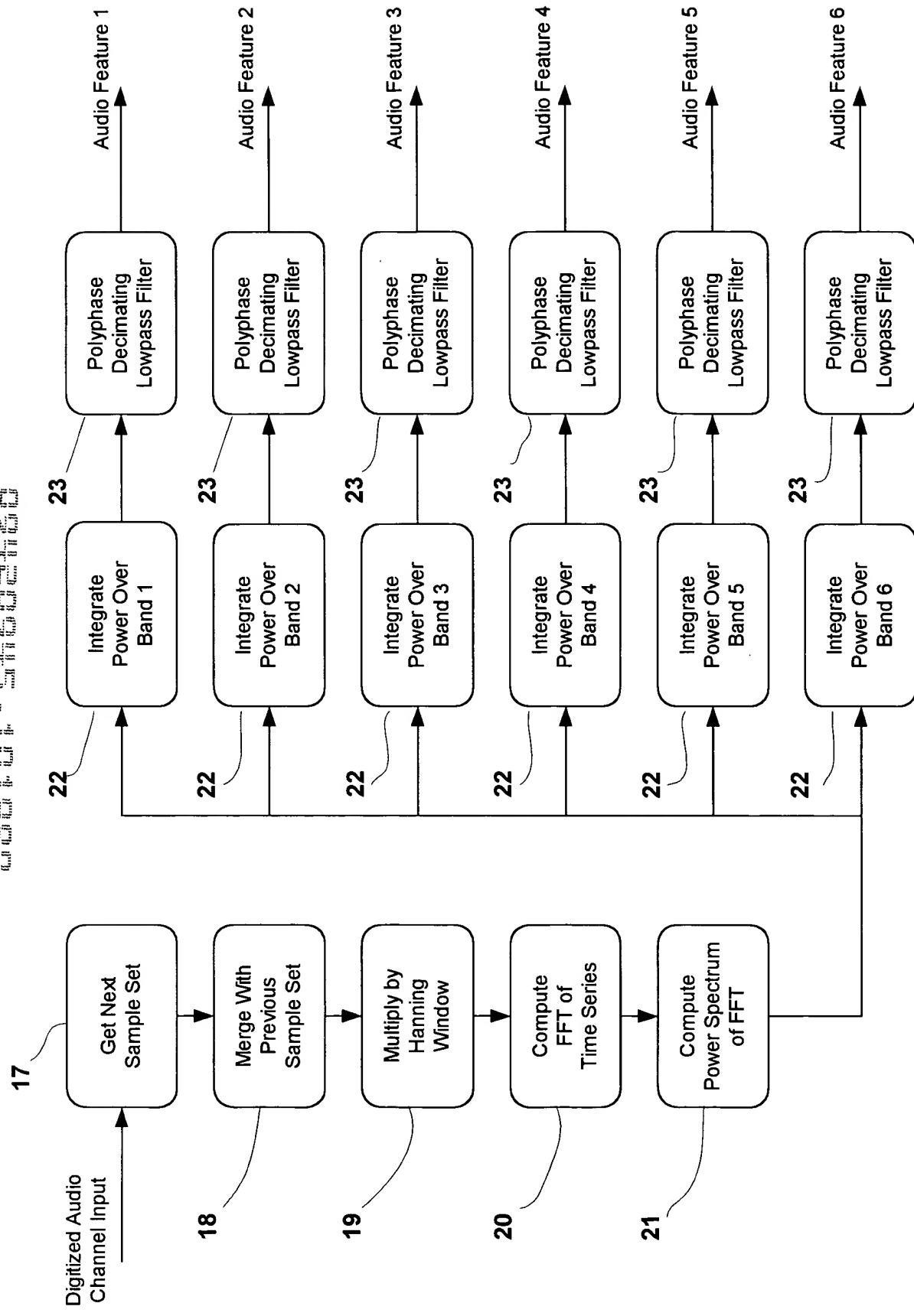
Figure 2: Audio Interface and Signal Processor

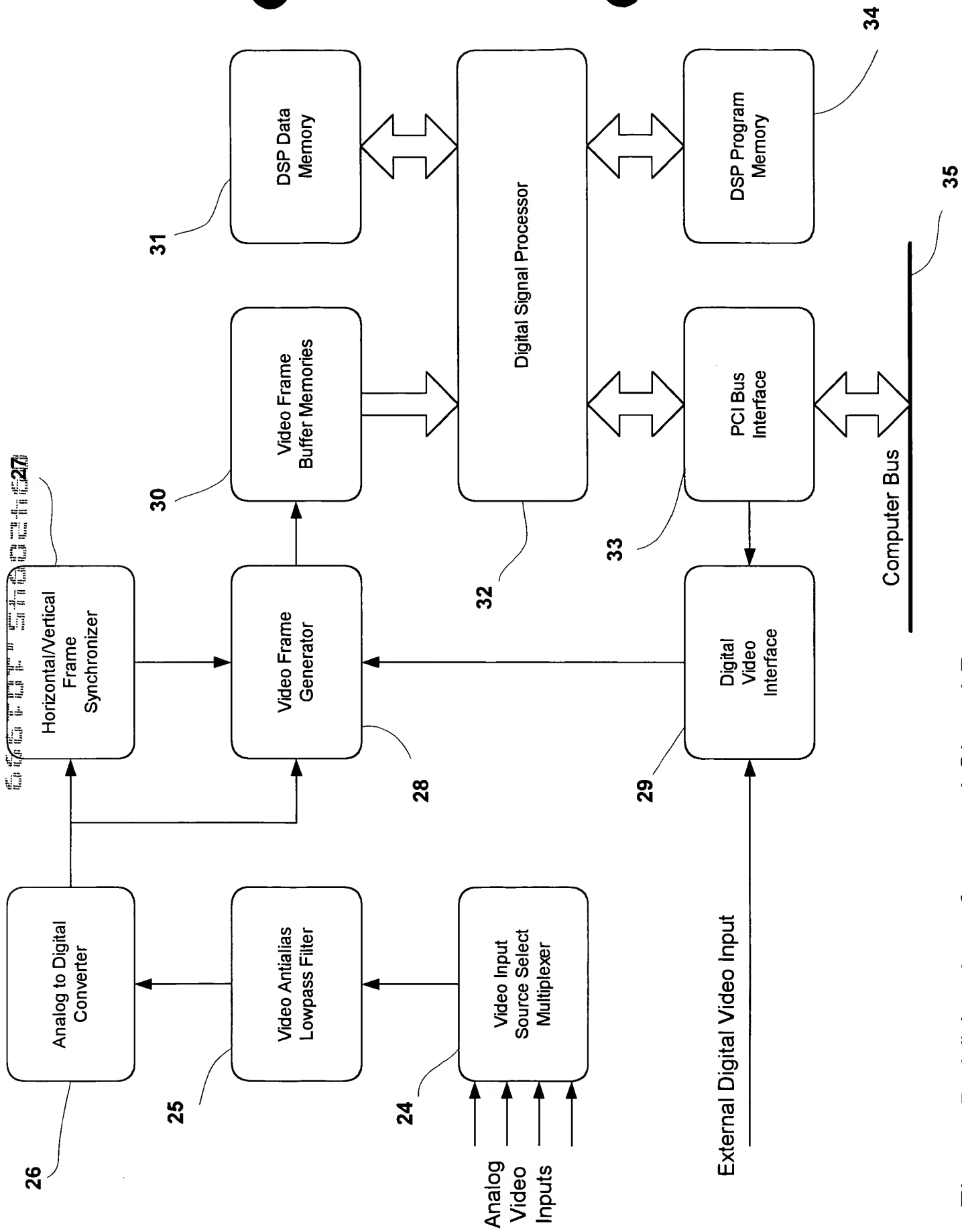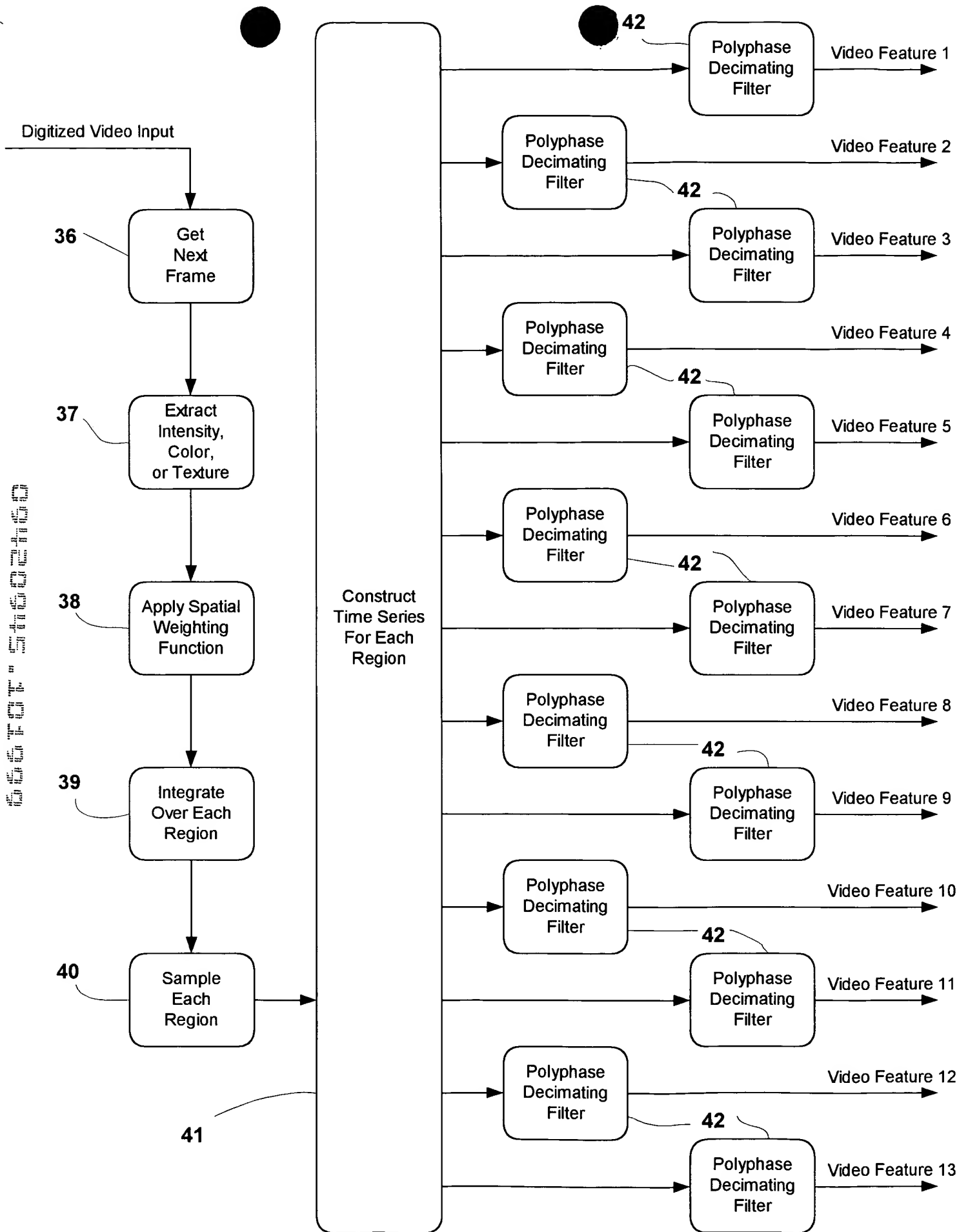Figure 3: Audio Spectrum Analysis and Feature Extraction

Figure 4: Audio Spectrum Analysis Bands

Signal Storage 27

Analog Video Inputs →	

Video Input Source Select Multiplexer **24**

Video Antialias Lowpass Filter **25**

Analog to Digital Converter **26**

Horizontal/Vertical Frame Synchronizer **27**

Video Frame Generator **28**

Video Frame Buffer Memories **30**

DSP Data Memory **31**

Digital Signal Processor **32**

DSP Program Memory **34**

PCI Bus Interface **33**

Digital Video Interface **29**

External Digital Video Input

Computer Bus **35**

Figure 5: Video Interface and Signal Processor

Digitized Video Input

36 — Get Next Frame

37 — Extract Intensity, Color, or Texture

38 — Apply Spatial Weighting Function

39 — Integrate Over Each Region

40 — Sample Each Region

41

Construct Time Series For Each Region

42

Polyphase Decimating Filter → Video Feature 1

Polyphase Decimating Filter → Video Feature 2

42
Polyphase Decimating Filter → Video Feature 3

Polyphase Decimating Filter → Video Feature 4

42
Polyphase Decimating Filter → Video Feature 5

Polyphase Decimating Filter → Video Feature 6

42
Polyphase Decimating Filter → Video Feature 7

Polyphase Decimating Filter → Video Feature 8

42
Polyphase Decimating Filter → Video Feature 9

Polyphase Decimating Filter → Video Feature 10

42
Polyphase Decimating Filter → Video Feature 11

Polyphase Decimating Filter → Video Feature 12

42
Polyphase Decimating Filter → Video Feature 13

Figure 6: Video Pre-Processing and Feature Extraction
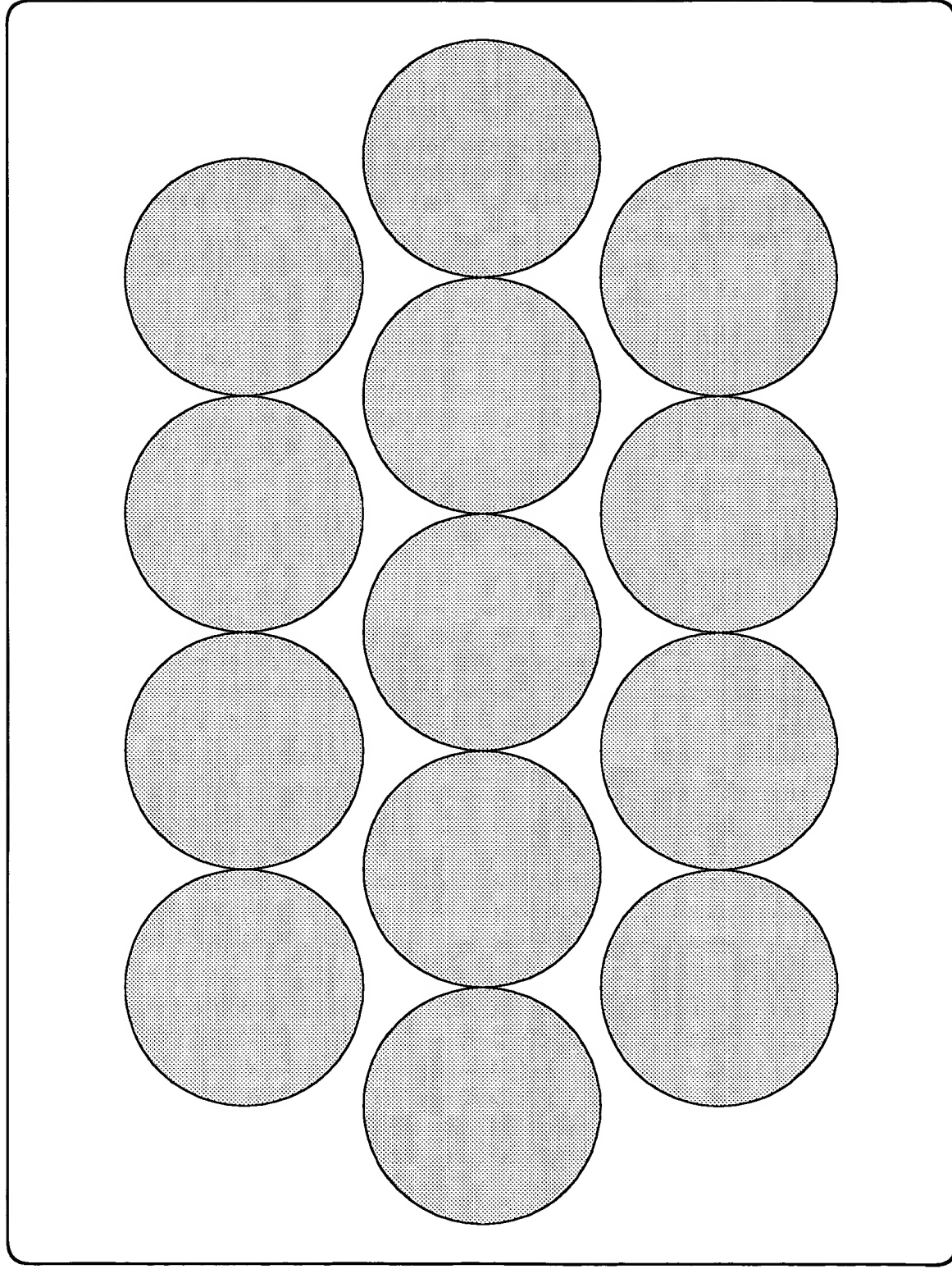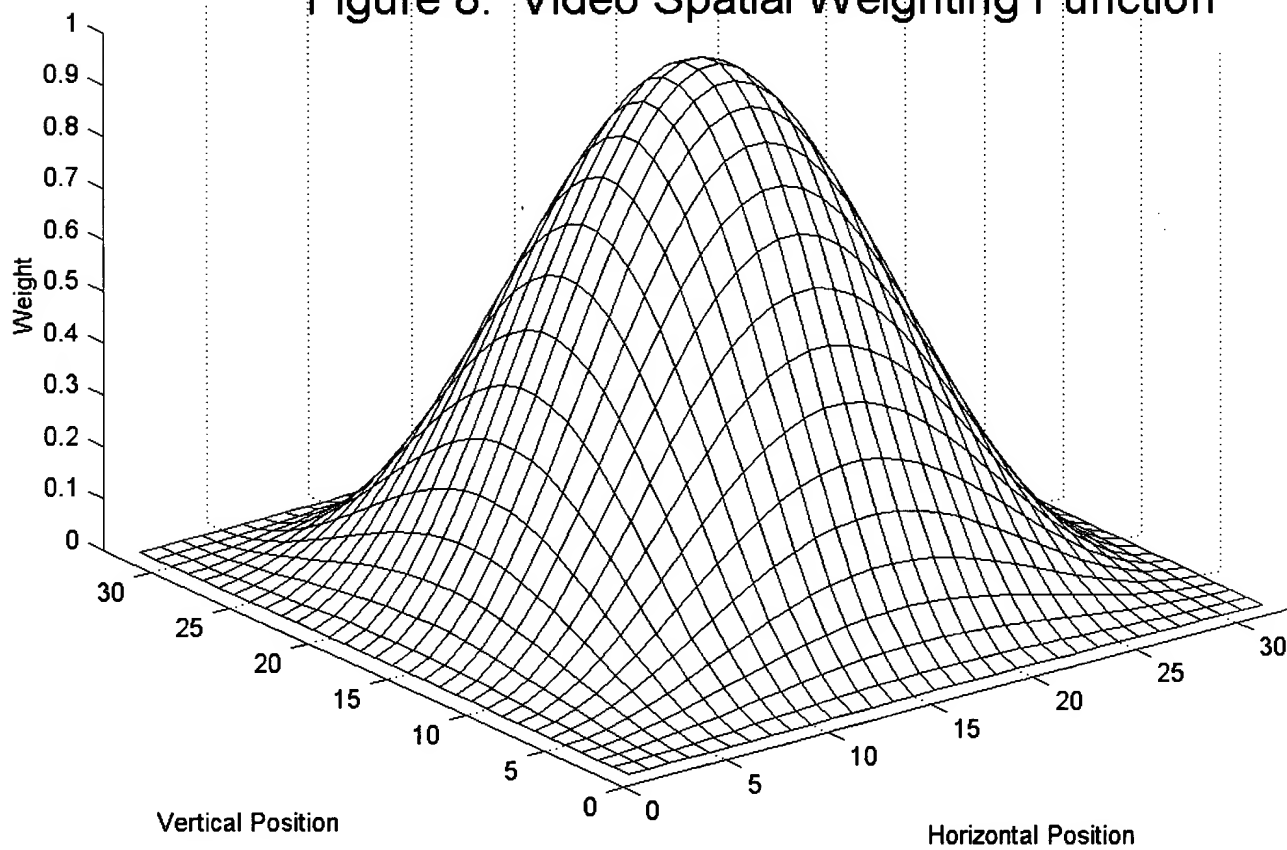
Figure 7: Video Feature Extraction Regions

Figure 8: Video Spatial Weighting Function

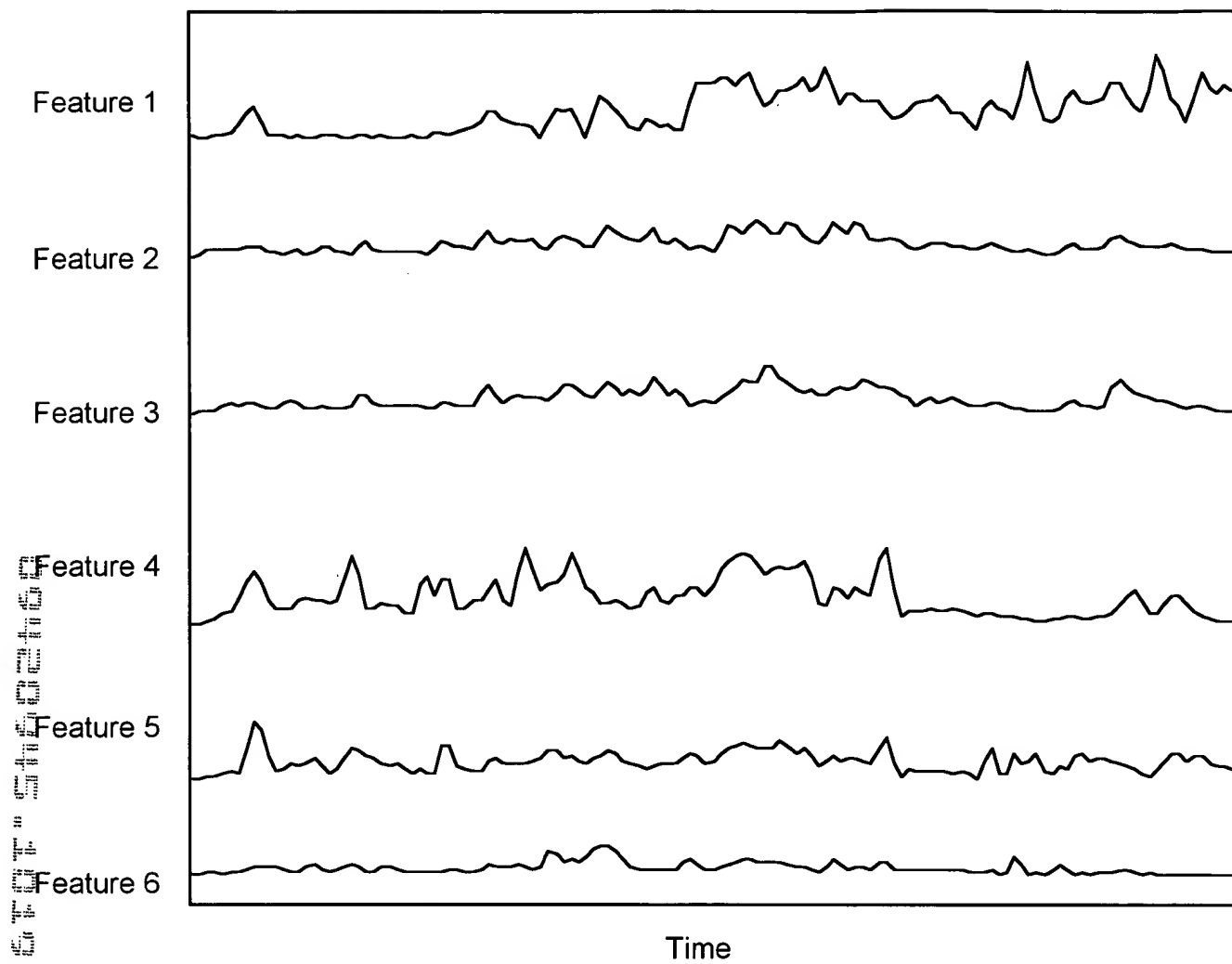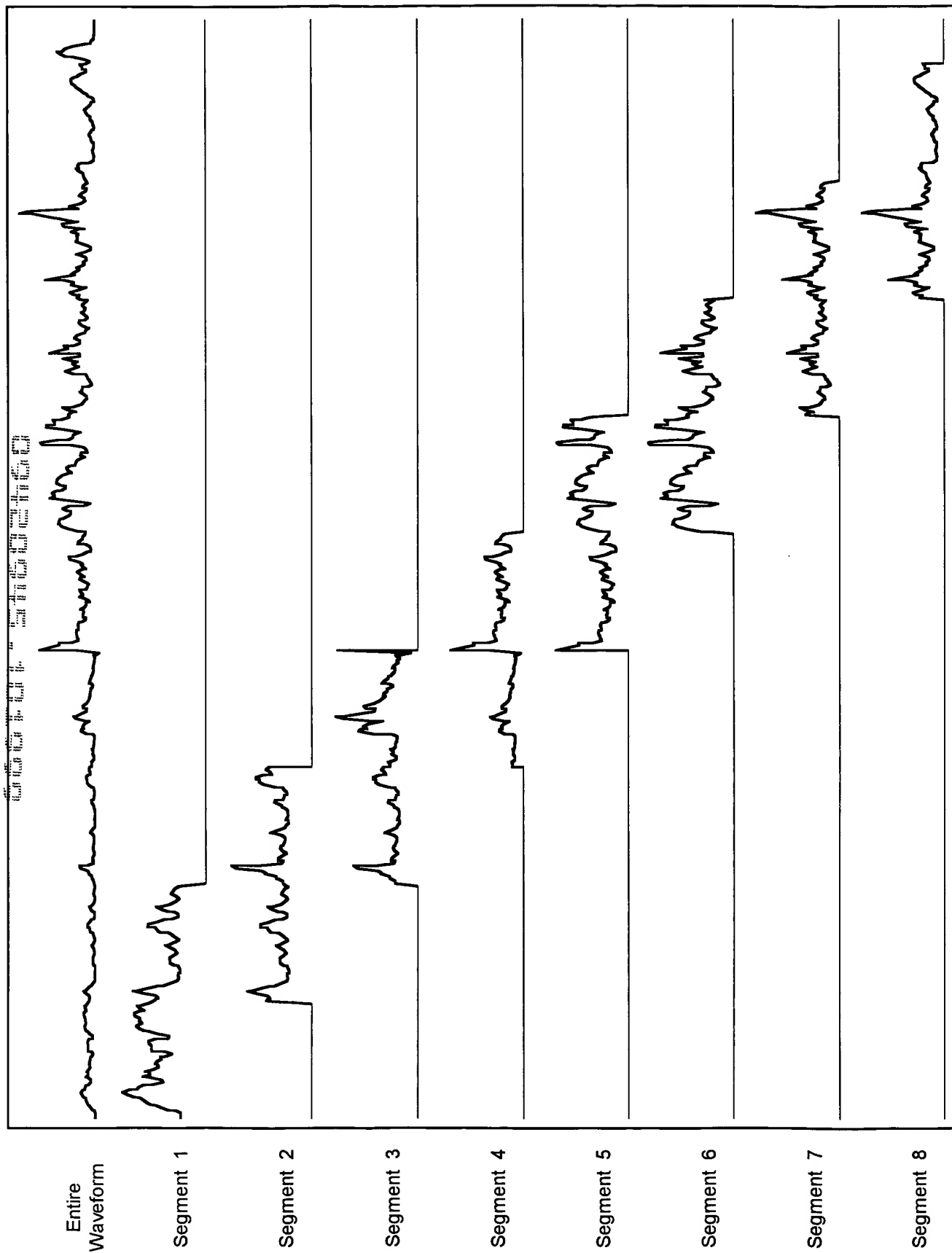Figure 9: Example Feature Waveforms
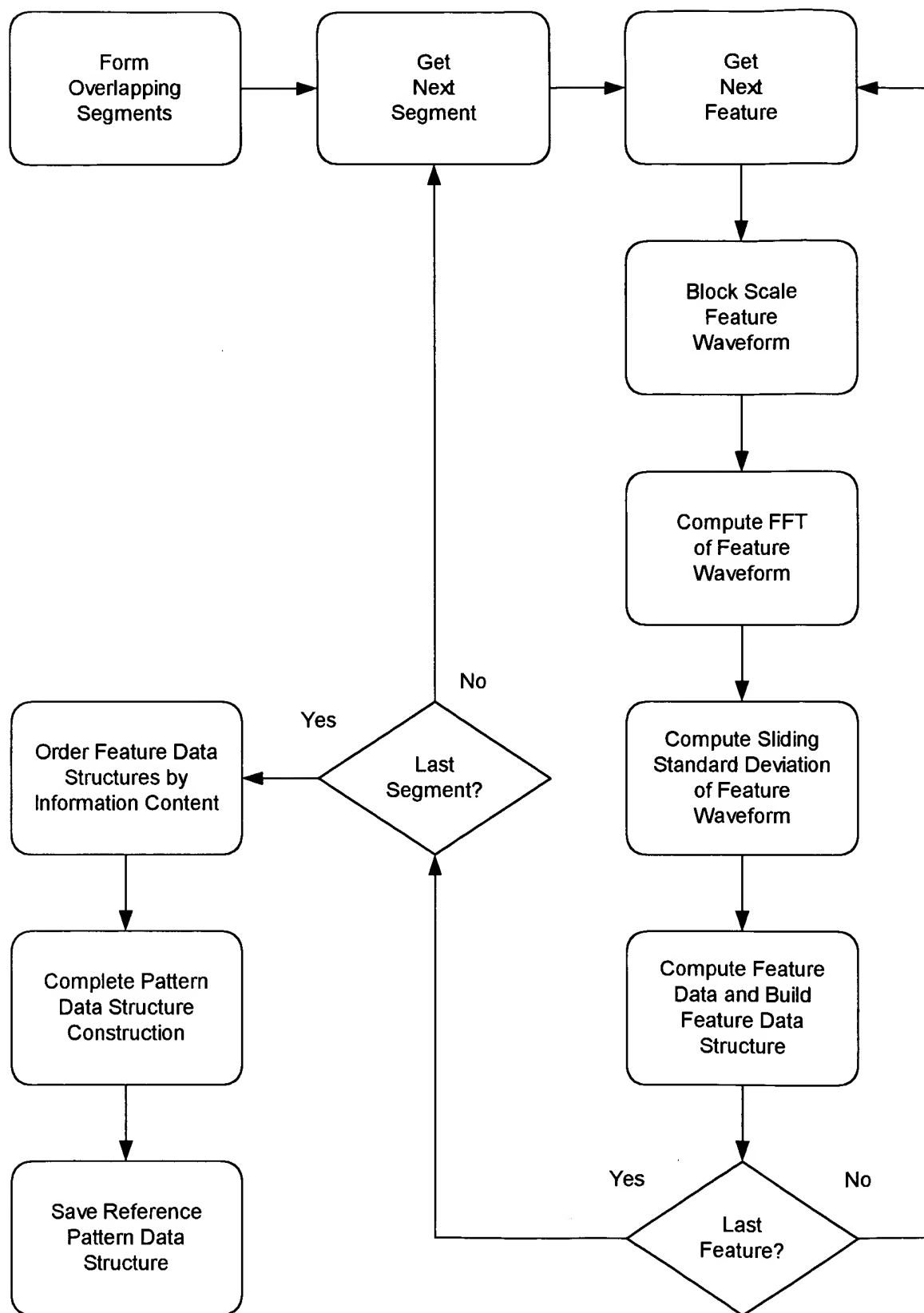
Figure 10: Reference Feature Waveform Segmentation
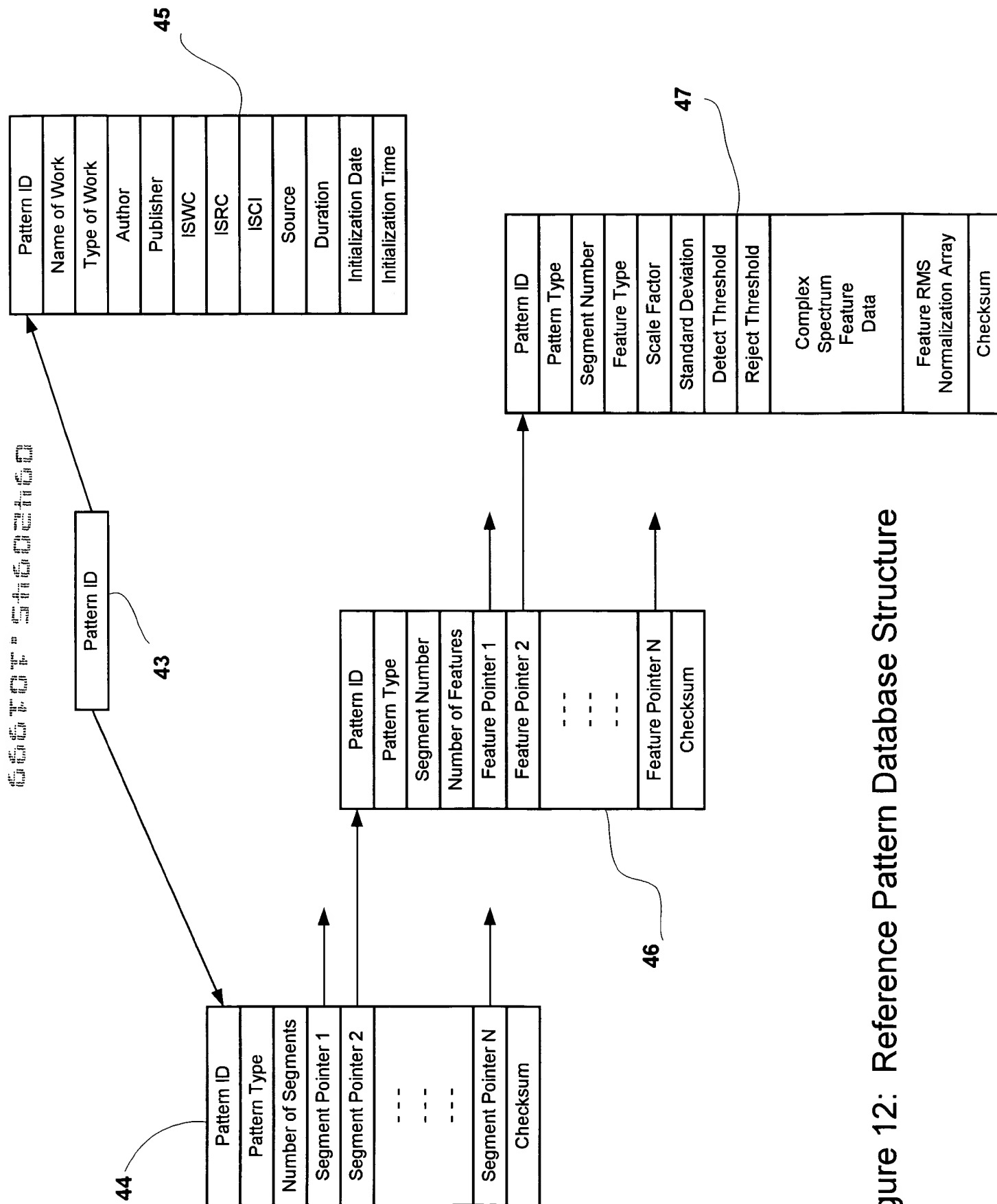
Figure 11: Reference Pattern Initialization

45

Pattern ID
Name of Work
Type of Work
Author
Publisher
ISWC
ISRC
ISCI
Source
Duration
Initialization Date
Initialization Time

43

Pattern ID

44

Pattern ID
Pattern Type
Number of Segments
Segment Pointer 1
Segment Pointer 2
- - -
Segment Pointer N
Checksum

46

Pattern ID
Pattern Type
Segment Number
Number of Features
Feature Pointer 1
Feature Pointer 2
- - -
Feature Pointer N
Checksum

47

Pattern ID
Pattern Type
Segment Number
Feature Type
Scale Factor
Standard Deviation
Detect Threshold
Reject Threshold
Complex Spectrum Feature Data
Feature RMS Normalization Array
Checksum

Figure 12: Reference Pattern Database Structure
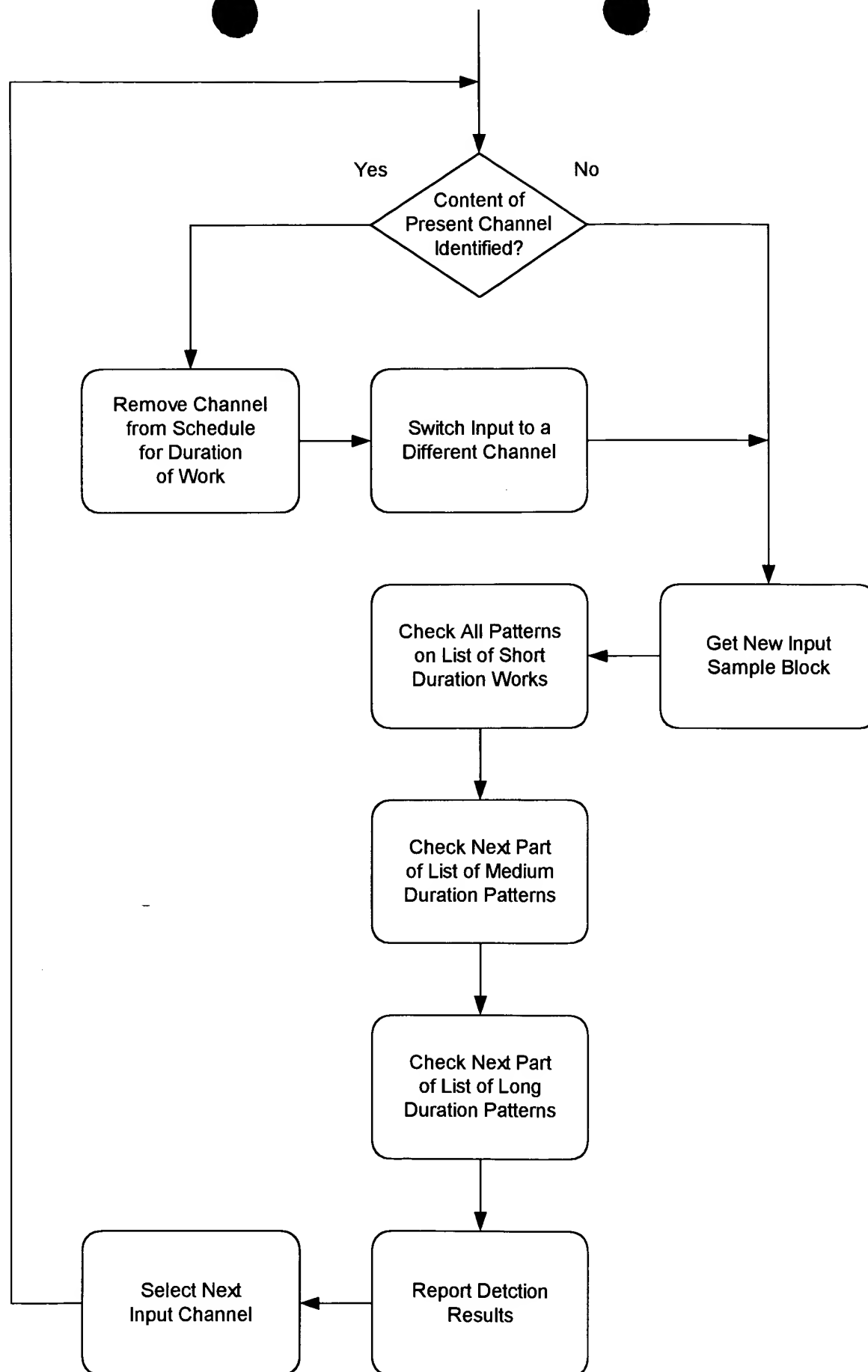
Figure 13: Input Channel and Pattern Scheduler

Input Feature Data → Get Next Input Feature Block

Remove Mean From Each Feature

Normalize Each Feature in Block

Pad Each Feature with Zeroes

Compute FFT of Each Feature → Pattern Matching Process
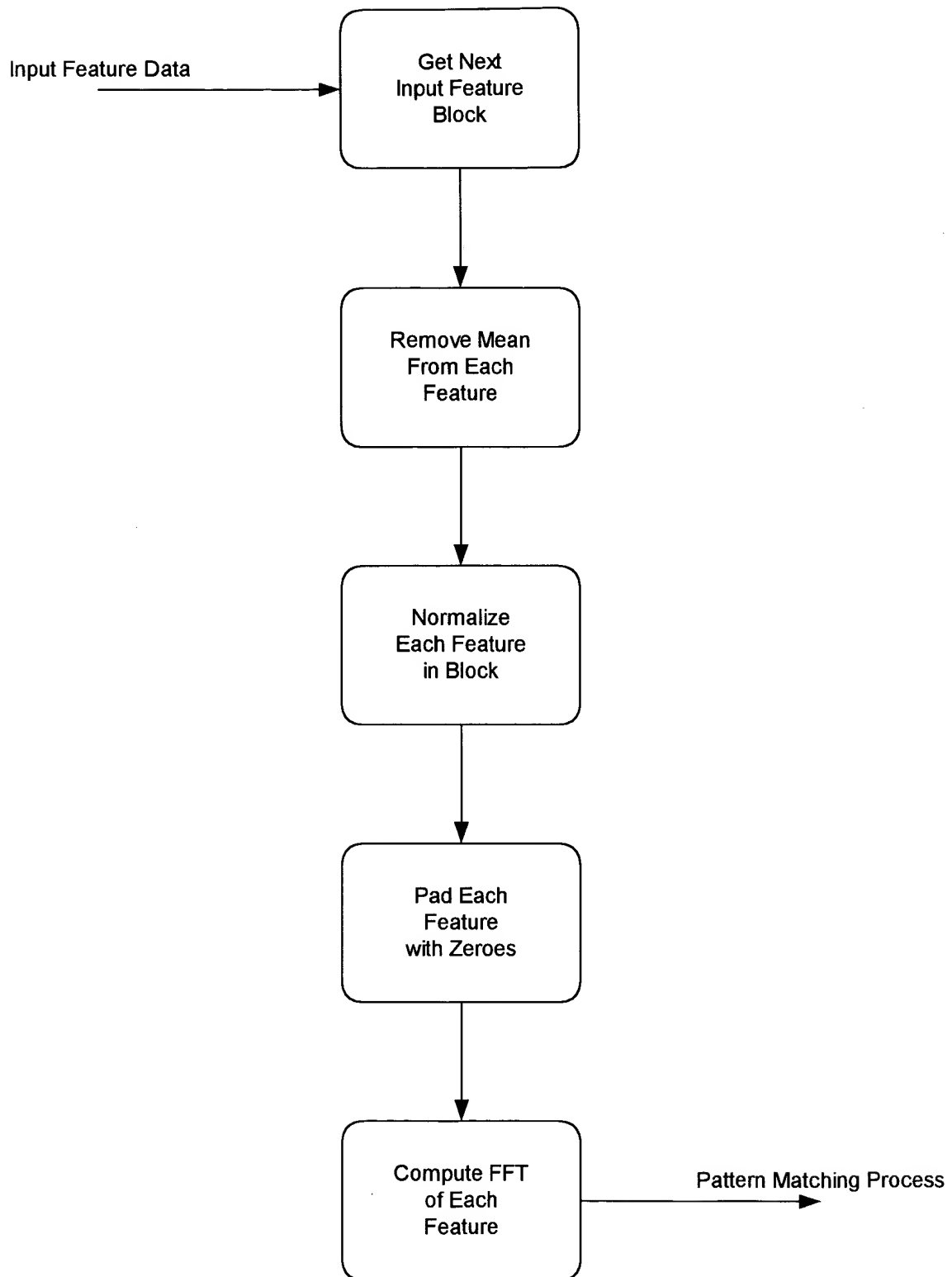
Figure 14: Real-Time Feature Block Pre-Processing
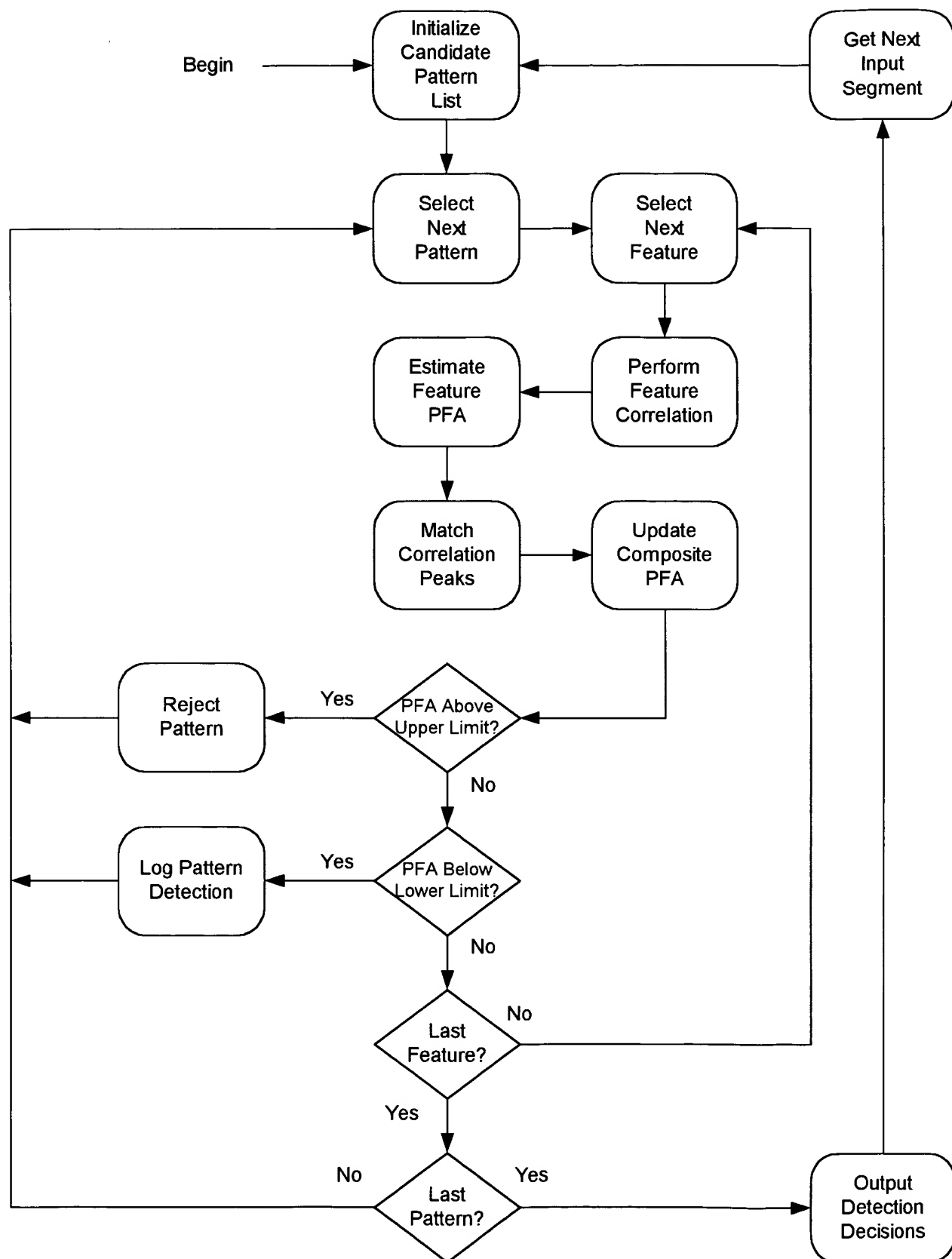
Figure 15: Multiple Feature Correlation Process

Unknown Feature
Complex Spectrum

Reference Pattern
Complex Spectrum

**Compute Cross-
Power Spectrum
Between Input
and Reference**

**Inverse FFT to
Obtain the
Correlation Function**

**Normalize First Half
of the Correlation by
the Stored Sliding
Standard Deviation**

**Discard the Second
Half of the
Correlation Function**

**Find Maximum Value
of Correlation Funtion**

Exit
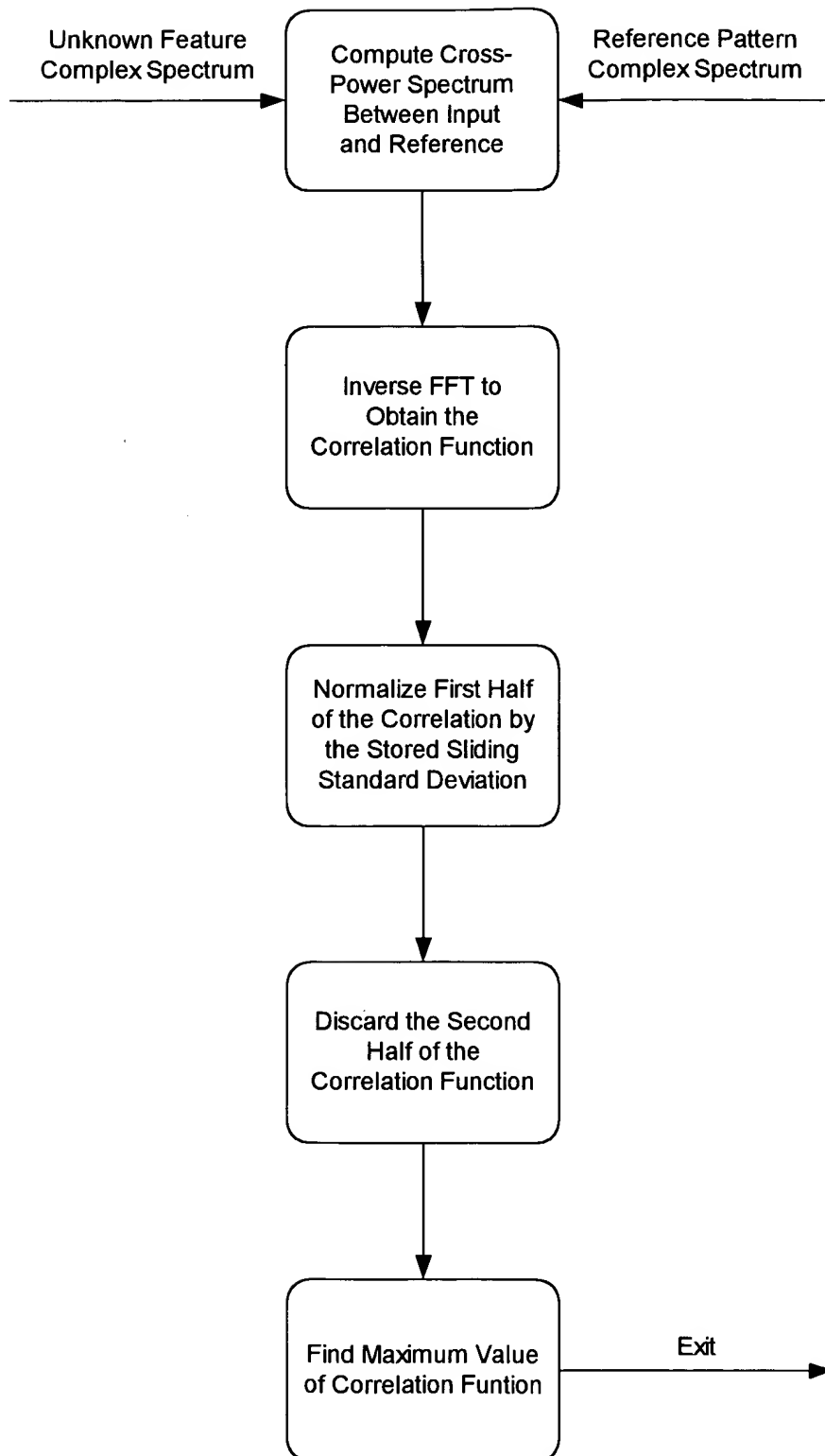
Figure 16: Feature Correlation Process
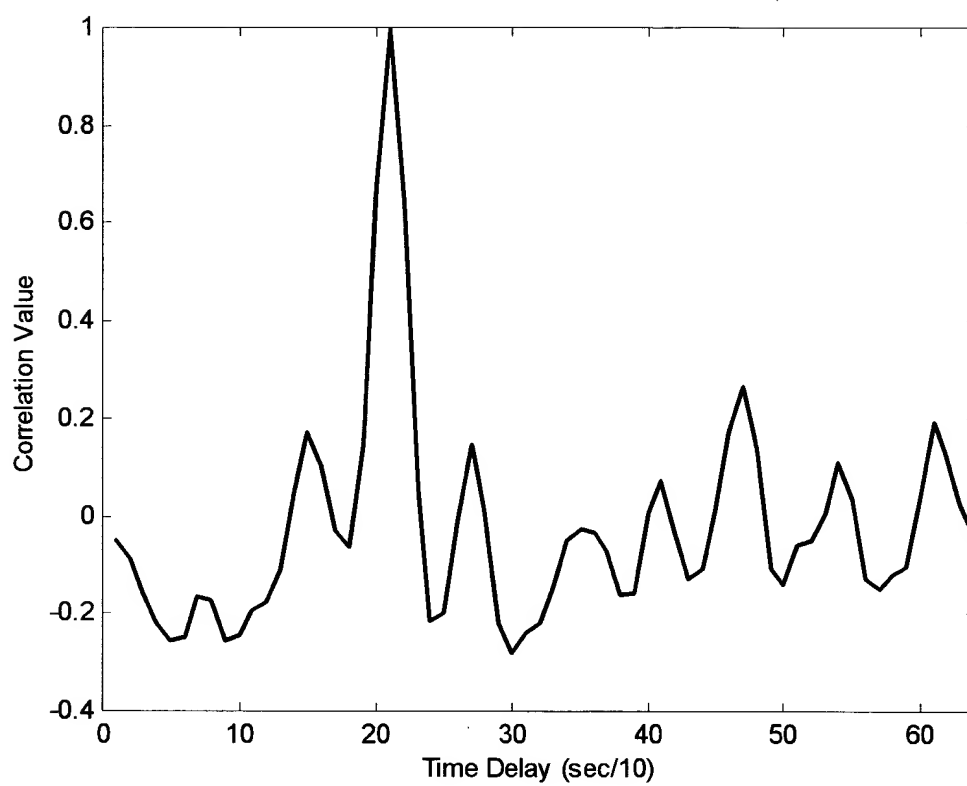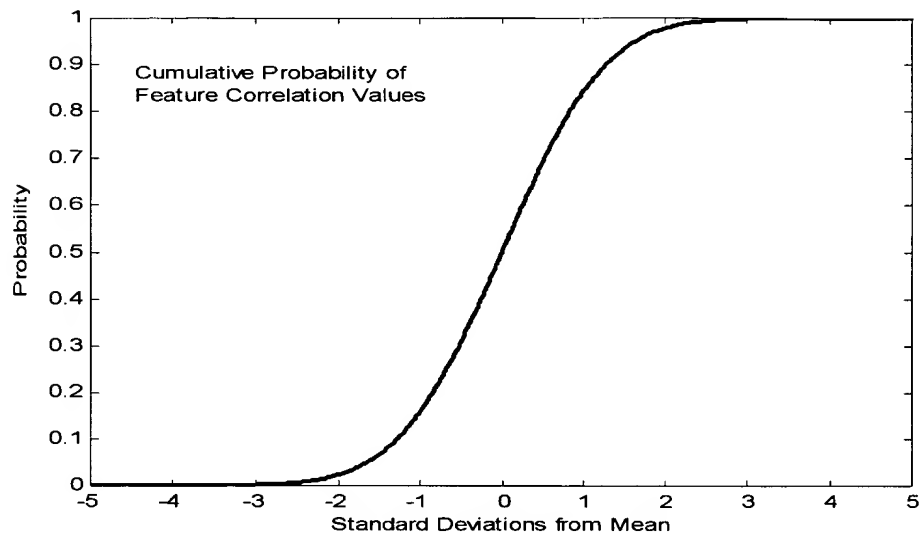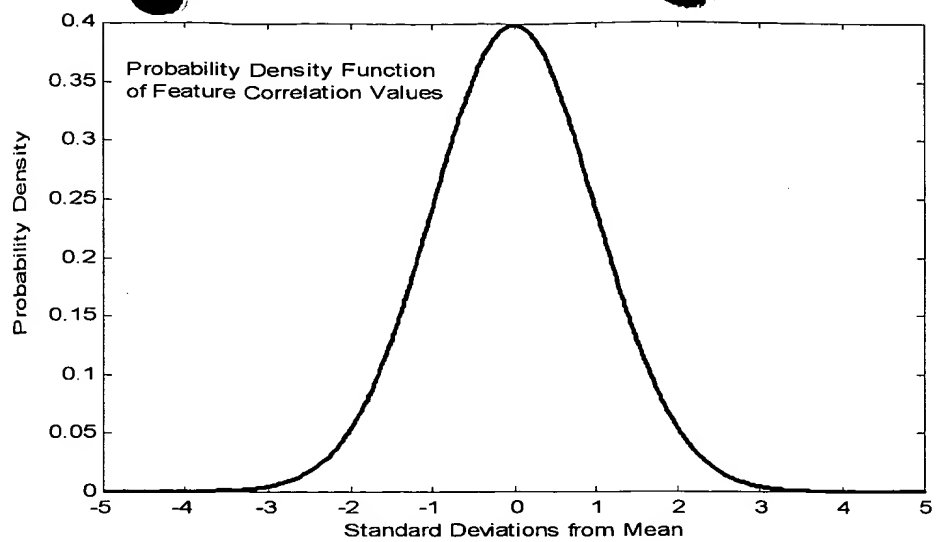
Figure 17: Example Feature Correlation Function

(A)

(B)

(C)
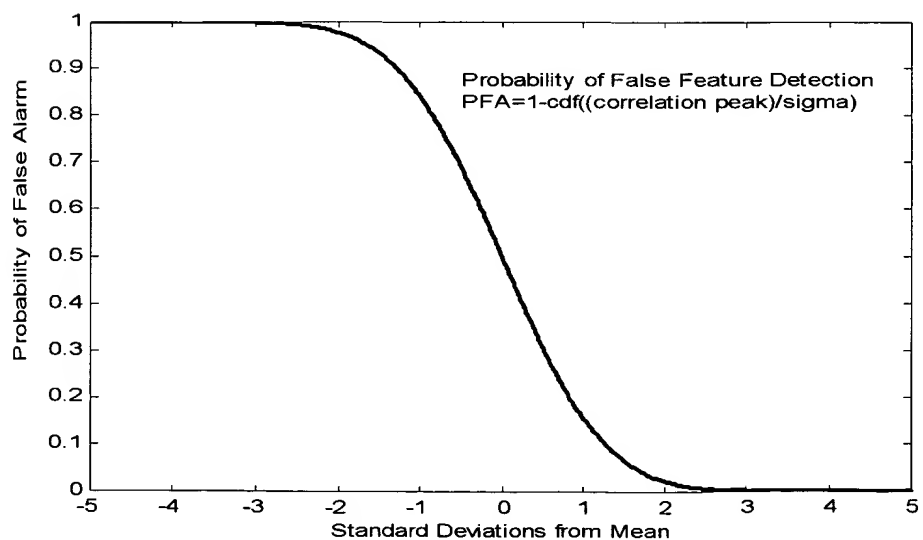
Figure 18: False Detection Estimation from Correlation Values